ZOÖLOGY.

The Habits of Fishes.[1] — The author contends that: Physiologically, fresh water (and probably all) fishes fall into two groups, — those which spawn in warming water and those which spawn in cooling water, and the cause of spawning is the temperature trend in *one* direction; structurally similar forms tend strongly to sustain similar relations to the temperature curve, *i.e.*, to spawn either all on its ascending, or all on its descending limb; in at least some cases apparent exceptions can be harmonized with the law; for a given species the temperature relations which determine its migrations, and probably also its geographical distribution, are the same as those which determine its spawning. These facts demonstrate the presence of a temperature-responsive nerve-mechanism, which is a character of prime importance, entitled to at least superfamily rank; its existence explains *why* with in-cooling spawning,[2] is (and must be) associated to-cooler migration[2] and boreal distribution (and with in-warming spawning, to-warmer migration and austral distribution); by a working backwards from the time of most successful hatching, the time of spawning has been determined via natural selection; that time so fixed, by a further working backward natural selection has determined the time of precedent migration; there are, *de facto*, beach spawners; in type of egg the beach spawners agree with the fresh water, and differ from the pelagic, forms, and this difference explains why species of pelagic genera are so rare in fresh water, and beach spawners are now uncommon, they having mostly become anadromes; for having attained to a seek-the-beach impulse, the conditions on the beach were such that, natural selection not opposing, the beach spawners must, through the mere continued action of the temperature-responsive mechanism, have been led, step by step, into the forming streams of a rising continent; and in the streams the necessary accessory instincts have been evolved, all in accordance with accepted biological principles. The most important generalizations are: Dynamically, fishes fall into two great groups according as they are stimulated to migrate geographically, to migrate for spawning, and to spawn, by warming water, or by cooling water; and this dynamic factor necessarily involves a northern limit to the range of

[1] Gurley, R. R. *Amer. Journ. Psychol.*, vol. xiii (July, 1902), pp. 408–425.

[2] *In-cooling spawning*, spawning in cooling water; *to-cooler migration*, migration from warmer water to cooler.

the species of the first group, and a southern limit to that of the species of the second group, the limit in each case being the point where the spawning temperature disappears; and the factor which has determined whether a given species was to remain a marine, or to become a fresh water form, has been the egg type. W. C. K.

Development of the Face. — As a contribution to the study of the external form of developing vertebrates, Rabl[1] has published eight quarto lithographic plates illustrating the development of the face in mammals. The species chosen are the rabbit, the pig, and the human being; and of the first as many as seventeen stages are shown. Each stage is illustrated as a rule by three views of the head: full face, profile, and three-quarters. The material from which the drawings were made was selected with as much care as the circumstances would permit, and fixed in picro-sublimate or in platinic chloride and sublimate. It was found advantageous for surface views to stain the embryos in Grenacher's alcoholic borax carmine. The surface configuration of such specimens has been rendered in the figures with exquisite fineness of touch, reflecting great credit alike on the draughtsman and the lithographer. The figures are not marred by descriptive lettering, but a sheet of semi-transparent paper is attached to each plate and bears the outlines of the figures and the lettering. The text is a running description of the material. Problems of external morphology are not discussed in it, though the author hopes that the work may afford a basis for the study of the laws governing the development of external form. Three more parts are to be issued covering presumably the other groups of vertebrates, and the whole will constitute an indispensable guide not only to the specialist in the development of the face, but to embryologists in general. Great credit is due to the author and to the publisher for the production of so beautiful a piece of work, and also to the Imperial Academy of Sciences in Vienna for its generous support. P.

Pectoral Appendages of Birds. — The latest published part of Fürbringer's[2] exhaustive studies on the comparative anatomy of the

[1] Rabl. C. *Die Entwicklung des Gesichtes.* Heft 1, Das Gesicht der Säugethiere, I. Leipzig, W. Englemann, 1902. vi + 21 pp., 8 pls.

[2] Fürbringer, M. Zur vergleichenden Anatomie des Brustschulterapparates und der Schultermuskeln. *Jenaische Zeitschrift für Naturwissenschaft*, Bd. xxxvi (1902), pp. 289–736, Taf. XVIII–XXII.